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ABSTRACT

This narrative describes the processes and technologies employed to produce and deliver a series of complex interactive learning experiences that brought together working scientists in Antarctic and students and teachers across North America. This multifaceted program included field production in the Antarctic, the use of experimental communications technologies to provide real-time interactive communication from across the globe, and the re-purposing of the educational materials from the live programs to produce an exciting and engaging interactive CD-ROM and Web site. "Live From Antarctica 2" was a series of three one-hour interactive television programs produced by Passport to Knowledge (Morristown, New Jersey) with considerable production support from the Mississippi State University Television Center in Starkville, Mississippi. This undertaking involved establishing bi-directional television broadcasting facilities in the Palmer Peninsula of Antarctica. Through these experimental facilities, NSF researches would be connected to the program originating facility at Mississippi State University and ultimately to students and teachers around the country through PBS and NASA-TV. Through a mix of communications technologies, students were able to ask questions and receive responses from the scientists working at their field research stations. The goal of the project was to bring science to life and to vividly illustrate the problems, challenges, and rewards of gathering research about the valuable wildlife, natural science, and ecosystems of the Antarctic. (AEF)

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ED 452 810

Digital Video – From the Desktop to Antarctica

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This narrative describes the processes and technologies employed to produce and deliver a series of complex interactive learning experiences that brought together working scientists in the Antarctic and students and teachers across North America. This multifaceted program included field production in the Antarctic, the use of experimental communications technologies to provide real-time interactive communication from across the globe, and the re-purposing of the educational materials from the live programs to produce an exciting and engaging interactive CD-ROM and Web site.

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The Mississippi State University Television Center (UTC) has been involved in producing interactive television programming since 1988. The unit's early involvement in satellite-based programming evolved into broadband fiber optic programming through participation in designing the nation's first publicly switched fiber optic distance learning network in 1991- Mississippi Fibernet 2000, (a public/private demonstration project). The Television Center's evolution continued into the realm of compressed video, streaming media, and interactive media development. The organization's staff and facilities have made the transition from a traditional television production facility to a full-scale multimedia, distance learning production unit capable of originating on-location or studio based interactive programming. The Center's facilities include nonlinear audio and video production suites, multimedia production work areas, interactive studios, and a hybrid production/KU uplink truck that has traveled from Pasadena to Nashville to originate national distributed interactive programs.

In recent years, UTC has been in the nucleus of some of the most ambitious distance learning projects in the nation including: "Live from the Stratosphere" that featured students and teachers interacting with scientists flying in NASA's KIPER flying observatory; "Live from Mars" which brought JPL's rocket scientists together with students at museums around the country when the Pathfinder spacecraft successfully landed on Mars; "Live from the Poles" that provided interactive programming from the North and South Poles; and "Live from Antarctica 2" the focus of this presentation.

The "Live From" series is produced by Passport to Knowledge, a Morristown, New Jersey company lead by Geoff Haines-Stiles and Erna Akuginow. (www.passporttoknowledge.com) A mutually beneficial working relationship was established between PTK and Mississippi State University shortly after the UTC's support of the "Live From the Stratosphere" program. PTK had established a proven track record working with NASA, NSF, the American Museum, and PBS. MSU had strong ties to NASA and NSF as well and considerable experience in distance learning program production. Our organization found the programming links through PTK to coincide with the outreach mission of Mississippi State University.

"Live From Antarctica 2" was a series of three one-hour interactive television programs produced by Passport to Knowledge with considerable production support from the Mississippi State University Television Center in Starkville, Mississippi. This ambitious undertaking involved establishing live bidirectional television broadcasting facilities in one of the most remote, and hostile areas on the planet – the Palmer Peninsula of Antarctica. Through these experimental facilities, NSF researchers would be connected to the program originating facility at Mississippi State University in Northeast Mississippi and ultimately to students and teachers around the country through PBS and NASA-TV. Through a mix of communications technologies, students were able to ask questions and receive responses from the scientists working at their field research stations. The goal of the project was to bring science to life and to vividly illustrate the problems, challenges, and rewards of gathering research about the valuable wildlife, natural science, and ecosystems of the Antarctic. The programs

clearly portrayed the awesome beauty and granger of the region and the immense value it has to our planet. The programs also provided a close-up view of what it is like to be a scientific researcher working in a challenging setting. The coordination and production of the series was an adventure that challenged the both the human and technology limits of all involved.

The Executive Producer of the series, Geoff Haines-Styles realized that getting a television signal out of Antarctica would not be an easy task. Geoff has a unique ability to find resource where no man (or woman) has gone before! His background as the director of the Cosmos series for PBS no doubt helped form his deep appreciation of science and sense of adventure inspired all of us involved in the electronic journey to Antarctica.

Through Geoff's special arrangements with NASA we were able to use the agency's ACTS (Advanced Communications Technologies Satellite) system to transmit signals to and from the region. This experimental satellite allowed our field production unit to use a small transportable uplink to broadcast a signal that could be downlinked at NASA's Jet Propulsion Lab in Pasadena. The audio and video signals were then digitized and compressed and sent more than 1700 miles across the country using a dedicated T-1 telecommunications circuit to Mississippi State University where the broadcast was integrated into the program mix.

Questions from students were brought into "Communications Central" at MSU from remote sites using transportable KU uplinks and compressed video facilities. For example, a group of middle school science students traveled to the NASA Stennis Space Center in Bay St. Louis, Mississippi where they were able to interact through video conferencing facilities. At other points in the programs, groups of students asked questions from a schools in Maine, California, Ohio and other locations where a transportable uplinks sent signals to MSU for inclusion in the program. Each program involved multiple origination sites from around the nation using similar technologies to support the question and answer segments of the program. E-mail and Fax questions were also received from students viewing the program over state or national educational networks. The rather significant technical challenge at MSU was how to synchronize the signals from multiple remote sites with the signal from Antarctica that was relayed through the JPL to MSU. The engineering team at MSU was lead by Mike Godwin, Chief Engineer with support from Andy Sims, Digital Systems Administrator, and Scott Lewis, RF engineer. These three individuals did an exceptional job in overcoming every technical obstacle that came their way. The Jet Propulsion Lab, which was also evaluating the ACTS system during our production, provided two engineers who were soon adopted by the Mississippi State team (Ann Deveraux in Antarctica at the Palmer Station T-5 transmitting station and Tom Rebold at MSU who was introduced to both Catfish and grits and survived!)

Since we were several time zones and half a globe away, often tape feeds from the field producers in Antarctica were made during the early hours of the morning when the

ACTS system was available for our use. Raw video and some pre-produced segments were digitally transmitted the Antarctic for editing at the MSU facility. Throughout the process the video quality remained good considering that the signal had traveled some 50,000 miles to get to us.

Several late night editing sessions were a necessity to modify the content of the packages which were included in each show. Videotape editor Ralph Olivieri, who was also the operations manager of the Television Center was the principle editor who worked closely with the executive producer and the program's director, David Hutto.

All the show elements were produced at MSU using either nonlinear or traditional editing suites. In many cases, special graphics were produced using the raw material received from Antarctica through the ACTS satellite. Image processing software, and digital compositing software such as Adobe AfterEffects were used to animate elements, "factoids," and transitional graphics, which added an extra dimension of quality to the production. Most of the graphics were designed and produced by Paula Hindman, Video Graphics Coordinator for UTC, who put in countless hours of work in developing high quality digital images and animations for the shows.

Minute by minute scripts were developed for all segments of the programs with careful attention given to time for interactive elements, student questions, and videotape segments. For each live program, an extensive set of contingency plans were made in the event of a signal loss from Antarctica (which happened three times during the broadcasts).

The organization of the educational components of the programs was well thought out and designed. A set of teacher resources was developed that provided schools with suggested lesson plans, maps, slides, audiovisual aids, videotapes, and resource links to prepare the students at local schools for the live "electronic field trips." When the broadcasts occurred, they were the culmination of several weeks of preparation that involved a comprehensive study of Antarctica.

A web site was also developed by PTK that was a significant support tool for the project. Teachers and students could access resource materials including maps, graphics, and other material that complemented the work in the classroom. Of particular interest were the journals of the scientists and researchers who were working in Antarctica. These online journals added personal insight into what it was like to live and work in this difficult but stimulating environment. The site is still active for review by interested individuals.
(http://passporttoknowledge.com/antarctica2/index.html)

The questioning strategy was well thought out and planned. The questions from the schools were all student questions, but were selected to support the educational objectives of each show theme to maintain continuity. A "Question Coordinator" monitored the "live" questions coming in through E-mail and FAX and coordinated them with the executive producer and host. At the appropriate time, in the right order

(most of the time) the questions were asked by the students or relayed by the show host from MSU. A contentious effort was made to have a representative balance of questions from different parts of the country and from students with diverse backgrounds.

When the programs came together, the final products were rich adventures for young scientists and their teachers around the country. More than 2.5 million students and teachers participated in the three programs that were broadcast by PBS's Teacher Support Services, NASA-TV, numerous state and regional educational networks, and local PBS stations.

The Development of Asynchronous Interactive Media

After the dust settled, we realized that more than 100 hours of original video footage was in the library, scores of original graphics, video packages, animations and sound effects that could be used to create a more in-depth interactive educational project. Geoff and I discussed in detail the possibility of repackaging all of our hard work into a more transportable, useable product for schools. The logical byproduct of this extensive collection of exciting material was to develop an interactive CD-ROM.

To accomplish this goal, a development team had to be formed. The TV Center Director, David Hutto would serve as Production Coordinator and Senior Designer. The Television Center's Special Projects Producer, Lamont Berger would be responsible for video editing and compressing all video sequences for the project. The missing member of the team was an accomplished graphic designer and multimedia programmer.

Since Mississippi State University is one of the few institutions in the nation that offers an MFA program in multimedia, it seemed only logical to recruit a qualified 2nd year graduate student who could benefit from the experience. The MSU Art Department recommended Erich Belk as a prime candidate for the project. After several meetings and some negotiation, he agreed to accept the challenge. The multimedia program at MSU is under the supervision of Ms. Anna Chupa who is turning out some highly qualified and talented young professionals. With our team in place, we were ready to begin.

The process for the development of the CD-ROM could be of value to those who may wish to attempt to produce a rather complicated CD-ROM. First of all we had to clarify our target audience, of course which turned out to be middle school science students. Secondly, we had to define the technical common denominator for distribution– the minimum computer platform used by our audience. Our research indicated that most of our target population would have access to Pentium II PC's with 64 MB's of RAM that had at least 4x CD-ROM drives.

With these minimum user requirements in mind, we began to experiment with graphics, video, and sound that would playback from a CD on this defined standard. Considering

the nature of the content available for the project, maintaining the highest quality was a primary design consideration for the development team. After some experimentation, we determined that the computers should be able to support a color space of thousands of colors as a minimum resolution. Our thought was that we would not try to design for the minimum standards at the time of production but aim instead toward a technology target at least one year in advance of our project's completion date. This decision in the short run might limit the potential distribution numbers, but in the long run would allow us to design for a higher quality output. Our logic was that most schools would catch up with us and pass our design standards quickly. Our strategy thus far has proven to be true.

The project director, Geoff Haines-Stiles was hopeful that as much of the Antarctica impressive library of material as possible could reside on the CD. Given our storage universe of 650 megabytes, the archiving capacity of a CD-ROM, this was a major challenge. One of our first steps was to determine how much video, audio, graphic, and text material could go into the project.

Toward this goal, we developed a project flow chart that mapped the content areas of the CD. At first broad strokes were used to define major areas of interest such as *Getting There, Transportation, Animals, People, Research, Weather, Survival on the Ice , Journals*, etc. in order to organize logical groupings of the resources. Next, we looked at the graphical interfaces, interaction design and navigation issues that would make the content easy to find and access.

Our principle designer, Erich Belk, was a gifted graphic designer as well as an excellent multimedia programmer. Erich developed the look and feel for all of the graphics for the project, designed the navigation icons, maps, section interfaces, and visual elements of the CD. Throughout the process, the work was evaluated by Erich's MFA thesis committee for aesthetic value, programming design, and logical content flow. This review process added a valuable dimension to the visual aspects of the project.

Several content management challenges were presented to the team. After an extensive review by the Passport to Knowledge staff, more than 100 minutes of video content were selected as vital to the program. In addition, it was deemed essential to include selected journals of the scientists and researchers, graphic images of animals with text descriptions of each and an audio file to let students know how each animal sounded.

It was not possible to store 100 minutes of full motion video with audio at the traditional 640 by 480 resolution so the size had to be reduced. The design team was concerned about loosing the quality of the sparkling original footage shot in Antarctica. A number of approaches were evaluated in our efforts to maintain high quality at a reasonable size. Different compression codecs, frame rates and image size combinations were evaluated over a period of about a month. Our final solution resulted in digitizing all of the scenes needed for the project and editing the packages on a Media 100 nonlinear editing system at an image resolution of 640 by 480 pixels per inch (ppi). When this process was complete, the edited packages were exported as

composite QuickTime Movies at 640 by 480 with audio. The exported movies were then cropped to remove some undesirable NTSC video characteristics such as VITC (Vertical Interval Time Code) and video head switching pulses on the bottom edge of each movie and compressed using Media Cleaner Pro at 320 by 240 ppi. The Sorenson Codec was used for the final compression to improve the image and audio quality. Custom settings were developed to control contrast, frame rate, deinterlace the frames, and to adjust image quality. A frame rate of 15 frames per second was chosen to reduce file size and still maintain acceptable smoothness. The resulting quality was very acceptable for playback on a 4x CD-ROM on a medium quality PC and Macintosh. In the end, we were able to include more than 100 minutes of full motion video on the finished product at very acceptable quality levels.

The major software development platform for the project was Macromedia Director. This particular software package is the foundation for the Multimedia Program in the Art Department at MSU and was familiar to the designer. In its final version, the CD is actually composed of numerous individual Director Movies tied together. This approach was taken to make file management easier and less cumbersome. In the original development version of the project, several "Extras" were used to maintain Alpha Channels on graphic images that were imported into the Director Programs. Other software programs that were very useful were Adobe Photoshop, Painter Most of the programming and image processing work was done on Macintosh Power PC's (G-3's with a minimum of 128 MB's of RAM) with proofing and testing of release versions done on Pentium II PC's with 64 MB's of RAM.

The "map" metaphor was used throughout the CD as a means of logically organizing the material and also as a means of orienting the young explorers to the content. Each location on the map provided information about how a person travels to the region, the research conducted there, and on the wildlife that lives in the area.

Creating the navigational interface for Awesome Antarctica, as the CD was now called, was crucial. Our goal was for the interface was to encourage students to explore the continent as an adventure. Not everything is directly presented to the explorer upon arrival, but is revealed through rollovers as the mouse is moved around the textured surfaces of maps of the regions covered by the CD. The navigation process, however, is very logical in its presentation. Animal pages are linked to McMurdo for example, because that is where most of the animals are found. Subtle points of fact are presented through the experience of accessing the information on the CD.

To make the content more interesting for students, we decided to develop a character to introduce each segment and serve as a humorous guide. Enter Penny the Penguin, an Emperor penguin with a cartoon voice who would pop up from time to time to introduce new elements of the CD. Penny was created with Macromedia Director as a movie loop. Its beak was rotoscoped to give the impression that it was speaking roughly in time (not exactly in sync) with the voice. Actually lip-syncing the voice would have taken us well beyond the scope of the project and completely blown budget, patience, and time goals.

The insightful journals of the Antarctic scientific team were valuable documents that we wanted to include on the CD. Our designer developed an attractive interface that included a picture of the individual scientists along with their journals. Where possible, this information was placed in close proximity to the video segment about their research.

The fascinating wildlife of the continent was displayed in its own section. To make this collection more interesting, we used high quality graphics of each animal represented along with a digital audio file of its sound. In most cases, we used sound from the video recording that we had acquired in the library. For some species, we used recordings collected by an independent recording artist who specialized in gathering sounds from nature. We found that the sound files needed to be digitized at 48 KB per second resolution to maintain adequate quality for our purposes and then recompressed at a lower rate to reduce file space when we integrated them into the CD. (The process was refined after numerous tests were done at different compression rates.) The links to the sound files were included in the fact sheets about each animal.

The major development of the CD took almost one year to complete. It involved the work of two graduate students over the course of a summer and consistent but not full-time involvement of a graduate student and one professional producer for the remainder of the year. Minor tweaking will be done after the final report from the focus groups is completed. When completed it will be made available to interested teachers and schools throughout the nation.

In retrospect, the project was a rewarding academic experience for the graduate students and faculty who were involved in the development and production process. The development of the CD allowed the MSU Television Center to explore and refine the process of digitizing media for CD distribution and to acquire new skill sets for multimedia development and production. The public/private partnership with Passport to Knowledge was informative and beneficial to all of the staff who participated in the project. It is our hope that the lessons learned in developing Awesome Antarctica will provide a solid foundation for future opportunities to grow in this exciting field of study.

APPENDIX

Brief Biography of David N. Hutto

David Hutto was raised and educated in Alabama. He grew up in a rural area of North Alabama where he learned to appreciate the beauty of nature, the simple values of hard work, and the joy of intellectual pursuits. He received his B.A. degree from Birmingham-Southern College, a demanding liberal arts institution, and a master's from the University of Alabama. Later he would do post-graduate work at Mississippi State University in educational media and programming. He has worked as a director of advertising production developing film, television, radio, and print material for campaigns and media outlets. He is a writer, media producer, and an administrator. For the past 25 years, he has been involved in higher education in a number of leadership roles.

He established the first television studios and full-time radio station at Mississippi State University. These state-of-the-art facilities rival any in the southeast and provide digital production capabilities for nonlinear audio and video editing, interactive studio production, distance learning program distribution through fiber optics, compressed video, and satellite communications. His unit also produced on-location programming through a hybrid video production and transportable KU uplink. Most recently, the TV Center has moved into streaming media production support and interactive media development.

Hutto has served as executive producer for national ALS programs for PBS, numerous instructional television series, interactive distance learning programs, and for multimedia programs for CD-ROM and Internet distribution. He is currently the Dean for Technology and Development at Blue Ridge Community College in Flat Rock, North Carolina where he is responsible for telecommunications, data operations, distance learning and instructional technology, public information, institutional planning, research, development, and institutional effectiveness. The College has just launched a new distance learning center and is expanding its digital media development capabilities under Hutto's leadership.

The presenter is also a writer and artist who has just published a collection of "wordscapes" titled "When Autumn Comes." The works include the title poem that was featured on NPR's *All Things Considered* in 1997. The wordscapes are narrated by a variety of voices and are accompanied by music and sound effects.

Live From Antarctica –2 Production Team

Passport to Knowledge:

Project Director:
Geoff Haines-Stiles

Executive Producer:
Erna Akuginow

Mississippi State University Television Center

Senior Producer and Director:
David N. Hutto

Technical Director / Video Tape Editor
Ralph Olivieri

Field Videographer – Antarctica
Bryan Ingleman

Show Host:
Cammile Moody

Video Graphics and Animation:
Palua Hindman

Chief Engineer:
Mike Godwin

Digital Systems Administrator:
Andy Sims

RF Engineer:
Scott Lewis

Awesome Antarctica Development Team

Passport to Knowledge:

Project Director:
Geoff Haines-Stiles

Content Editor:
Erna Akuginow

Mississippi State University Television Center

Production Producer and Senior Designer:
David N. Hutto

Graphic Designer and Multimedia Programmer
Erich Belk

Video Producer and Multimedia Coordinator
Lamont Berger

MSU Art Faculty
Anna Chupa

SOFTWARE USED:

Multimedia Programming:
Macromedia Director 6.5 and 7.0

Audio Processing:
Sound Edit 16
ProTools – Session 8

Image Processing:
Adobe Photoshop
Fractal Painter 5.0

Digital Video Editing:
Media 100
Media Cleaner Pro

Video Compositing:
Adobe AfterEffects

CD Burning:
Toast

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Abstract

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